PROJECT NUMBER: 1812
PROJECT TITLE : New Expanded Tobacco
PROJECT LEADER : E. B. Fischer
PERIOD COVERED : December, 1990

I. BATCH GASEOUS CO_2 IMPREGNATION

A. **Objective:** Define process parameters for a batch gaseous CO_2 impregnation process.

B. **Results:** "Shake-down" runs on the 8-inch tower/impregnator system were initiated using gaseous CO_2 at 800 psig. Modifications to the conveyor transfer device from the impregnator to the tower were identified to improve the handling of the gaseous CO_2 impregnated filler. Installation of a new transfer pump system is scheduled for this week. Design of a larger capacity vaporizer has been finalized; fabrication is being worked out with the vendor. Both modifications are needed to increase the capacity of the pilot system.

Discussions with PM Engineering and Kellogg were held to come up with a preliminary cost estimate for installing a batch gaseous CO_2 process with a design pressure of 1000 psi in Cabarrus.

C. **Plans:** Complete modifications on the 8-inch tower/impregnator pilot plant unit and begin experimental grid for evaluating the gaseous CO_2 batch process.

II. CONTINUOUS IMPREGNATION PROCESS

A. **Objective:** Develop a continuous impregnation process to improve the subjectives of expanded tobacco while maintaining equivalent cigarette filling power to the existing process.

B. **Results:** Securamax has completed 90% of the design work on the high pressure rotary valve. They analyzed the thermal profile of the valve for heat generation during rotation. The analysis indicated that it is feasible to cool the valve by external cooling providing 85% of the heat is transferred to the housing.

Securamax submitted a quotation to fabricate a rotary valve of pilot plant size (500 lbs/hr) for $310,783.

A scope document has been generated for the continuous conveyor impregnation process to analyze gas recovery system requirements.

C. **Plans:** Stress analysis being performed by Securamax will be completed and Securamax will make the necessary drawing modifications to complete the high pressure rotary valve design.

Develop and analyze the gas recovery system for the continuous conveyor impregnation system and detail the design of the belt conveyor.

B. Results: In order to achieve plug flow separation of tobacco, several baffle designs were installed and tested on the 8-inch tower tangential separator. At the Cabarrus flow condition (145 ft/sec), the desired plug flow separation of tobacco from the tower gas was not achieved. However, at significantly reduced flow conditions (30 ft/sec or 20% of Cabarrus flow), acceptable plug flow separation was achieved with two different baffle arrangements. The impact of this finding on the new tower design is being assessed.

A positive displacement feed valve, designed to minimize any pre-expansion of impregnated tobacco, was tested on the 8-inch tower. Preliminary data indicated that the CV behavior was in line with the colder tower temperatures and higher exit tower OV's obtained. Valve design modifications needed to achieve choke-free operation at subzero temperatures have been identified and a redesign of the feed valve is underway.

Based on successful feasibility of the U-tube separator/eductor system on the 3-inch tower, scale-up design effort on the 8-inch tower has been initiated.

C. Plans: Complete plug flow testing on the tangential separator. Finalize design modifications to the feed valve. Finalize design of U-tube separator/eductor/ tangential separator system for the 8-inch tower.

VII. CHEMICAL STIFFENING

A. Objective: Define a process to chemically stiffen expanded tobacco which will reduce thermal treatment and the associated subjective degradation while maintaining cigarette filling power equivalent to the current process.

B. Results: Extensive testing both in the 3-inch and 8-inch pilot processes has shown that cut filler can be chemically stiffened to enhance product CV. In addition, this stiffening effect continues to be present at much higher than normal tower exit OV's (8-12%) which should make it possible to substantially reduce the thermal treatment and subjective degradation associated with the expansion process. Testing to date has consisted primarily of applying a solution of calcium acetate to uncased DIET feedstock prior to impregnation. A 2.7% add on of calcium acetate with a three hour bulk time produces a product CV increase of about 1.5 cc/g at equivalent tower conditions. Testing is in progress to determine the net result in cigarette performance including subjective evaluation.

Magnesium acetate was evaluated as an alternative stiffening additive because it offered increased solubility over calcium acetate and thus more process flexibility. The magnesium acetate treated filler produced expanded product with improved CV over the control and similar to calcium acetate treated filler. However, its presence increased the equilibrated OV of the product by .1% making it difficult to fully evaluate.

C. Plans: Tests are being planned to evaluate the addition of calcium acetate on strip prior to cutting.

III. ALTERNATE CONTINUOUS IMPREGNATION PROCESS

A. **Objective:** Evaluate the linear pocket processor (LPP) for continuous impregnation of tobacco filler.

B. **Results:** The design of the model linear pocket processor was completed. The fabrication of component parts is nearly complete and assembly has begun. the unit should be available for testing by mid January.

C. **Plans:** The model LPP will be used to evaluate the tobacco feed and discharge designs for the prototype LPP.

IV. TOBACCO COOLING

A. **Objective:** Develop a continuous cooling process in support of the gaseous carbon dioxide impregnation program.

B. **Results:** The continuous cooling unit and the associated refrigeration package have been received and are being installed.

C. **Plans:** Complete the installation of the Frigoscandia test unit in D pilot plant.

V. ALTERNATE PUFF/DRY/SET PROCESSES

A. **Objective:** Define alternate means of puffing, drying, setting and reordering impregnated tobacco to improve product subjectives and physical characteristics relative to the present DIET process.

B. **Results:** A 3-inch development tower arrangement was used to evaluate expansion at elevated temperatures (up to 900°F), temperature quenching of product in line to 150°F, and the U-tube separator concept. Filling power data for product from the test arrangement was similar to that from the conventional 3-inch system. Flavor Development is evaluating the subjective character of the ET produced. The U-tube separator and eductor system operated well, although some breakage occurred in this small scale arrangement.

C. **Plans:** Conduct subjective evaluation of the high temperature, quick cooled ET. Complete evaluation of physical data. Scale-up U-tube/eductor system for testing on the 8-inch tower.

VI. TOWER HEAT TRANSFER RATES

A. **Objective:** Develop process information to define heat transfer parameters for the design of a new expansion tower. Test process concepts on the 8-inch tower leading to process and product improvement.